



The DAsKIT programme: status and plans

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With collaboration of
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Outline

- > *Motivation & Goals*
- > *Tools & Methodology*
- > *Progress & Status*
- > *DA starters KIT*
- > *Conclusions & Outlook*





Motivation & Goals: 2016-2018

2016 Toulouse Strategy Meeting:

@http://www.umr-cnrm.fr/aladin/IMG/pdf/6_mou.pdf

Operational configurations		RUN OVER																
		Algeria	Belgium	Bulgaria	Morocco	Poland	Portugal	Tunisia	Turkey	Austria	Croatia	Czech Rep	Hungary	Romania	Slovakia	Slovenia	France	
RUN BY	Algeria	ALADIN 12					ALADIN 12	ALADIN 12								ALADIN 12		
	Belgium		ALARO 4															
	Bulgaria			ALADIN 7														
	Morocco	ALADIN 18	ALADIN 18	ALADIN 18	AROME 2.5		ALADIN 10	ALADIN 18	ALADIN 18	ALADIN 18	ALADIN 18	ALADIN 18	ALADIN 18	ALADIN 18	ALADIN 18	ALADIN 18	ALADIN 18	
	Poland		ALARO 4	ALARO 4		AROME 2.5												
	Portugal						AROME 2.5											
	Tunisia							ALADIN 12										
	Turkey			AROME 2.5					AROME 2.5		ALARO 4.5			ALARO 4.5		ALARO 4.5		
	Austria			ALARO 5						AROME 2.5	AROME 2.5	AROME 2.5	AROME 2.5			AROME 2.5	AROME 2.5	
	Croatia									ALARO 8	ALARO 2	ALARO 8	ALARO 8			ALARO 8	ALARO 2	
	Czech Rep			ALARO 4.7	ALARO 4.7		ALARO 4.7			ALARO 4.7	ALARO 4.7	ALARO 4.7	ALARO 4.7	ALARO 4.7	ALARO 4.7	ALARO 4.7	ALARO 4.7	
	Hungary			ALARO 8	ALARO 8		ALARO 8			ALARO 8	ALARO 8	ALARO 8	AROME 2.5	ALARO 8	AROME 2.5	AROME 2.5	AROME 2.5	
	Romania												ALARO 6.5	ALARO 6.5	ALARO 6.5			
	Slovakia			ALARO 9	ALARO 9		ALARO 9			ALARO 9	ALARO 9	ALARO 9	ALARO 9	ALARO 9	ALARO 9	ALARO 9	ALARO 9	
	Slovenia			ALARO 4.4						ALARO 4.4	ALARO 4.4	ALARO 4.4	ALARO 4.4			ALARO 4.4	ALARO 4.4	
	France			AROME 1.3													AROME 1.3	

ALADIN/ALARO/AROME configurations horizontal resolution in km with DA without DA

Domain	Cycle	Grid	DA	forecast length/ cycle
AEMET	38h1.2	2.5 km 65 lev	3DVar + surf ana	48h/4times
DMI	38h1.2	2 km 65 lev	blending + surf ana	54h/4 times
FMI	38h1.2	2.5 km 65 lev	3DVAR + Surf ana	54h/8times
KNMI	36h1.4.bf1	2.5 km 60 lev	3DVAR + Surf ana	48h/8 times
LHMS	37h1.2	2.5 km 60 lev	blending + Surf ana	54h/4 times
MetEireann	37h1.1	2.5 km 65 lev	blending + Surf ana	54h/4 times
MetCoOp	38h1.2	2.5 km 65 lev	3DVAR + Surf ana	66h at 00,06,12,18, 3h at
VI-Iceland	38h1.2	2.5 km 65 lev	blending + Surf ana	48h/4 times

SPDA Goal: develop a cross-consortia coordination to set-up a basic 3D-Var data assimilation cycle with a limited set of observations suitable for operational implementation

The goal is thus to provide a Data Assimilation Kit (DAsKIT), which should be flexible and easy to handle, even with low manpower. Target DA solution has to account with short HPC resources and/or particularities of regional observation networks (for instance, not all countries are ECMWF(3 Members: Be, Pt, Tk; 2 Co-operating: Bg, Mo; 3 none: AI, Tu, PI) /EUMETNET/EUCOS members or cooperating members)

Identification of main steps (suitable for operational, research) -> dynamical task (after Météo-France, LACE, HIRLAM methods)

Available cross-countries DA tools -> dynamical task (after Météo-France, LACE, HIRLAM methods)

Good communication platforms

Joining the pieces together (training, becoming technical acquainted, tuning the system)





Tools & methodology: 2018-2020

WHAT

Verification

HOW

home-made (surf, upper-air)/monitor/**HARP**

Global model
CPL

LAM time
integration

IFS(ECMWF)/**ARPEGE**

AROME/ALARO/HARM_AROME

Obs
acquisition

Obs pre-
processing

ODB
(BATOR)
processing

Data
Assimilation
cycling (+QC)

home-made PP/SAPP
OI_MAIN/blending/3D-Var/
comb.(OI_MAIN+ 3D-VAR)

Obs
monitoring

Data
blacklisting

h-made/**obsmon**/obstat/LACE

local/ECMWF/**Meteo-France**

Diagnostic
tools

mandalay/obsmon/odbsql

!!!! and, of course, the workflow for each source code version (scripting system)...

Ecflow/ksh:
OLIVE/HARMONIE/home-made



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Slovenia





Progress & status: Milestones

2017

DA WD

GTS BUFR SYNOP processing (BATOR)

2018

DAsKIT KICK-OFF
Inquire

Surface DA KIT

REF.: AROME_PT2, CY40_t1_bf07, L46, 2.5km, 12UTC, GTS BUFR SYNOP@M-F

DAsKIT & LACE WD

surfDA ref (to be ported and cycled); mandalay/obsmon; HARP; SAPP

2019

DAsKIT (surface) local implementation

surfDA; mandalay; obsmon; HARP; SAPP

DAsKIT & LACE WD

validation of surfDA;
GTS BUFR AMDAR processing
LACE combined 3D-Var sample

2020

DAsKIT (combined)

BATOR CY43 (SYNOP, TEMP, AMDAR);
validation of surfDA;
porting of 3D-Var; building KIT



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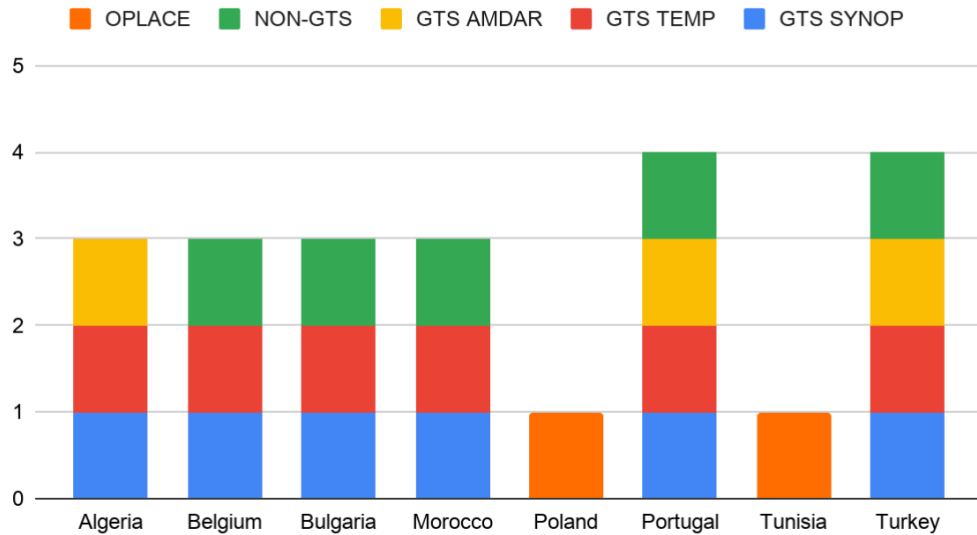
ARSO METEO
Slovenia



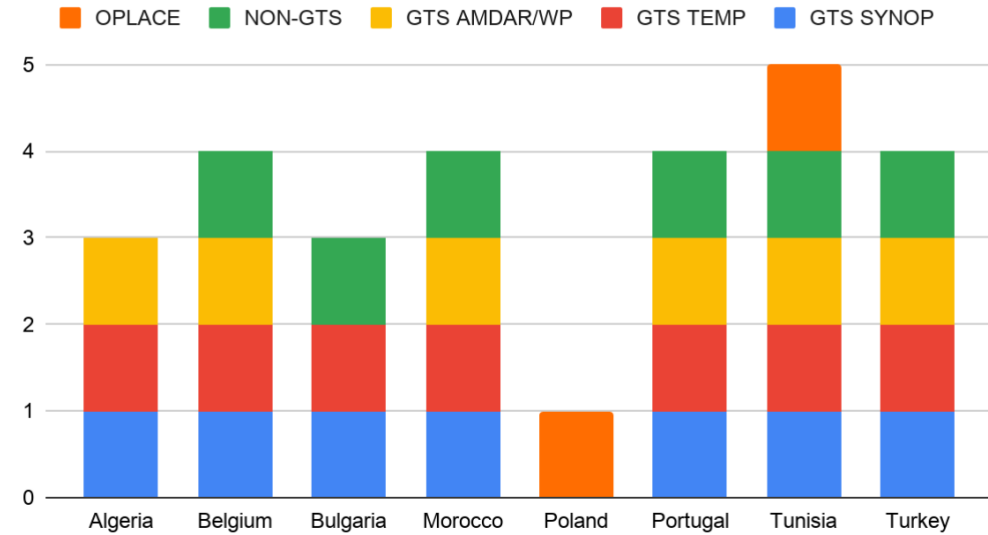


Progress & status: Data Acquisition

Conventional observations - START 2018



Conventional observations - START 2020



There was a progress on Data Acquisition in the past 2 years

- > 8/8 countries have access to GTS SYNOP, TEMP (Poland receives OPLACE data)
- > 6/8 countries have access to GTS AMDAR (Poland, Tunisia receive OPLACE data)
- > 5/8 countries have access to non-GTS (local) SYNOP data
- > 1/8 countries have access to non-GTS (local) Wind Profilers (Tunisia)



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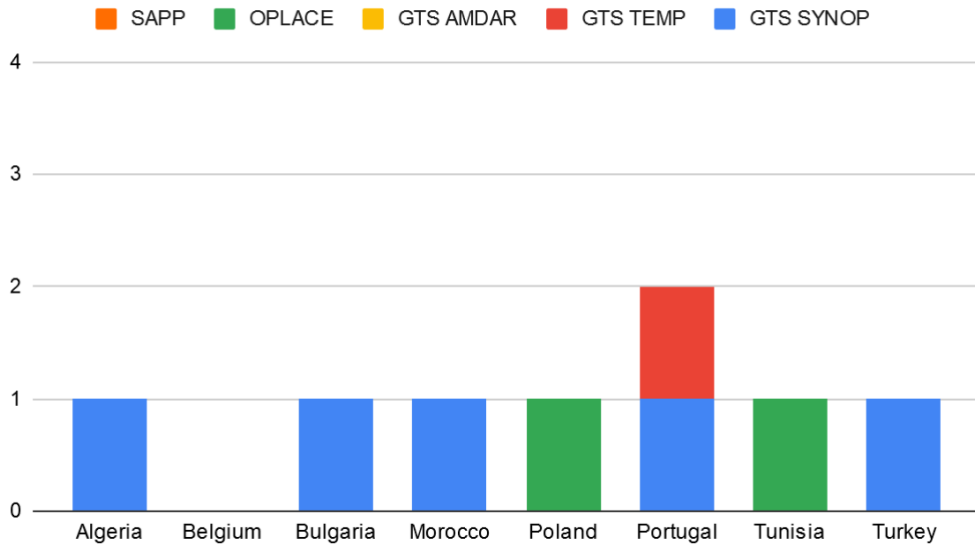
ARSO METEO
Slovenia



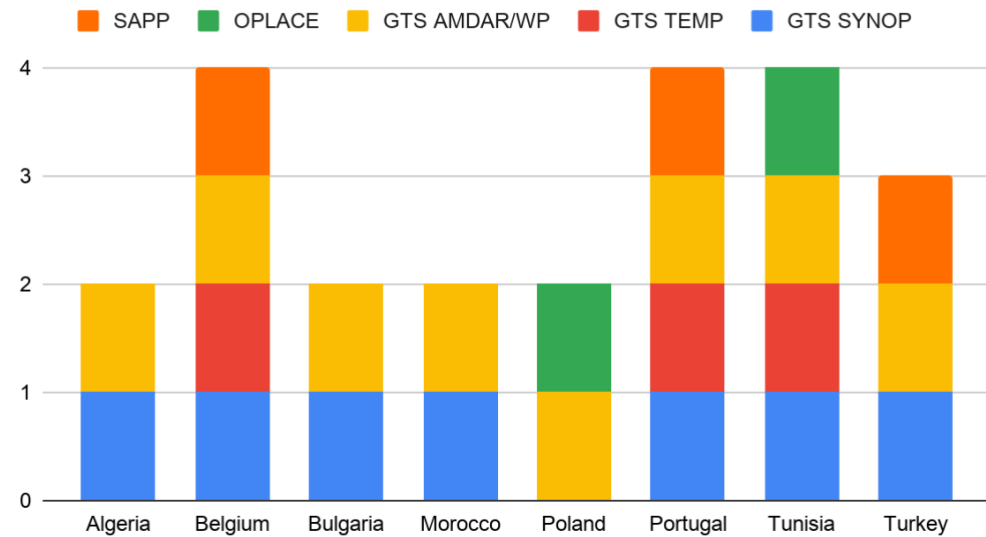


Progress & status: Data pre-Processing

Conventional observations - START 2018



Conventional observations - START 2020



There was a progress on Data pre-Processing in the past 2 years

- > 8/8 the countries have some know-how to handle SYNOP, AMDAR BUFR duplications, due to corrections and amends, and template filtering (an AMDAR action with demo data was used for training, in case of Bulgaria, Poland and Tunisia)
- > 2/8 have now general tools (Belgium, Bulgaria) to pre-process data
- > 2/8 still rely on OPLACE pre-Processing

Simultaneously,

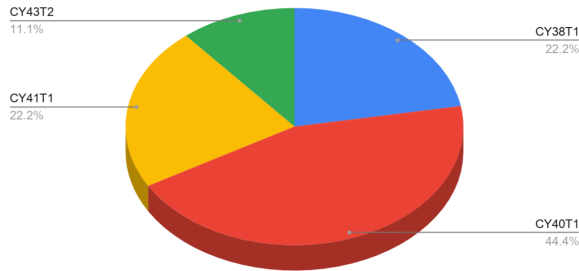
- > 3/8 countries have on-going efforts to implement SAPP (Scalable Acquisition and Pre-Processing, ECMWF)



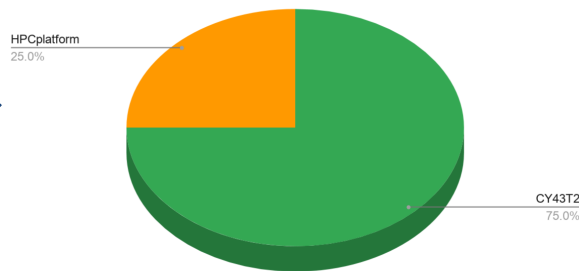


Progress & status: ODB(BATOR) pre-Processing

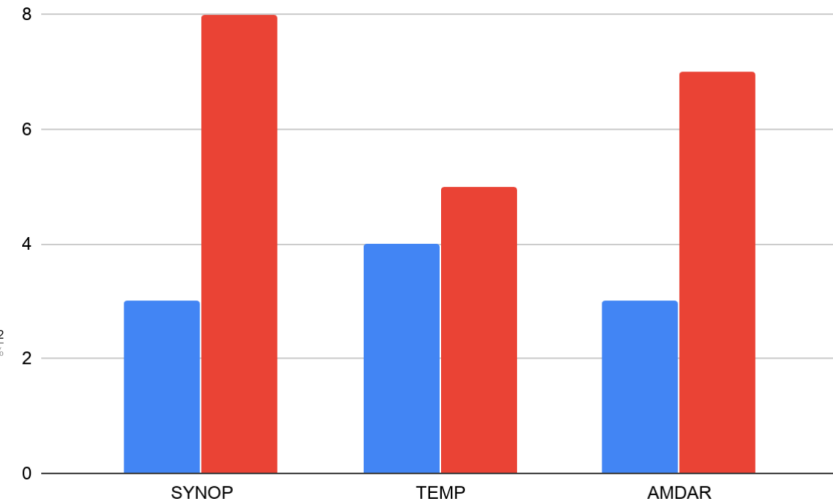
BATOR implementation - START 2018



BATOR implementation - START 2020



BATOR implementation - START 2018 vs. START 2020



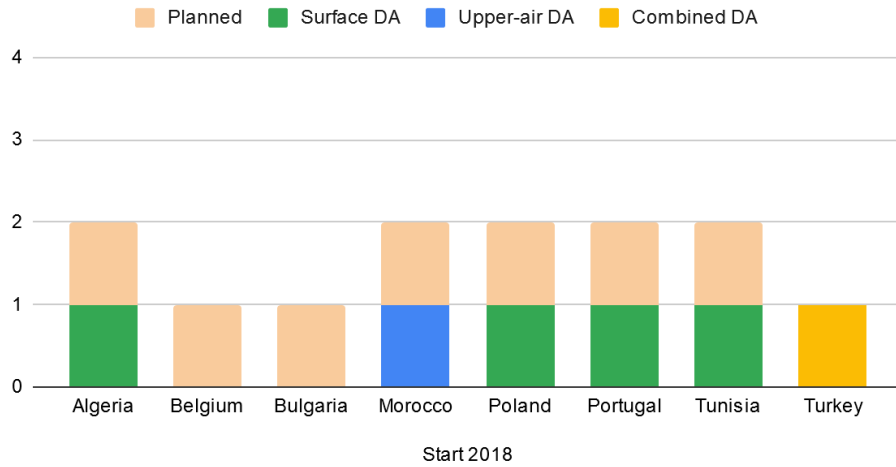
There was a progress with BATOR implementation in the past 2 years

- > 6/8 the countries are now using the same version of BATOR (CY43T2_bg10)
- > skills in the countries have improved and
- > more countries are now able pre-processing the 3 types of conventional obs: SYNOP, TEMP, E-AMDAR
- > in particular all the countries are now able to pr-process SYNOP data
(an action on GTS BUFR SYNOP was done)

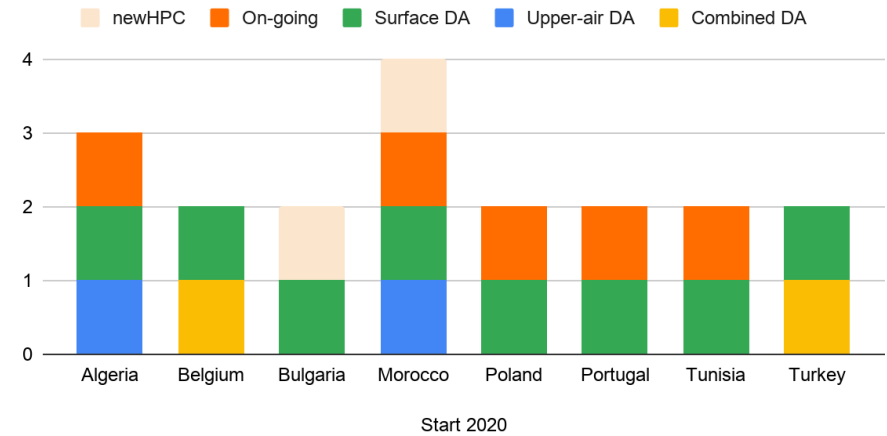


Progress & status: Local DA cycling

Combined DA, Upper-air DA, Surface DA and Planned - START 2018



Combined DA, Upper-air DA, Surface DA, On-going and newHPC - START 2020



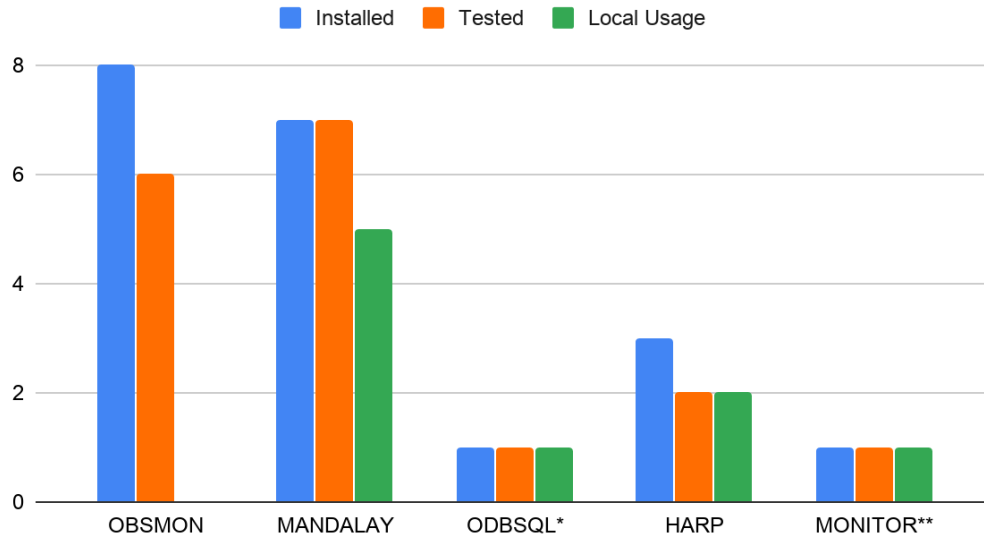
There was a progress on local DA cycling implementations in the past 2 years

- > 8/8 countries are able to cycle a surface DA system (green bars)
- > 2/8 countries are able to cycle **LOCALLY** a combined OI_MAIN+3D-Var DA system (yellow bars)
- > 2/8 have fronsen their activity due to lack of computing resources



Progress & status: Data Monitoring, Diagnostic, Verification

Installed, Tested and Local Usage - START 2020



* no investment was done in DAsKIT because not all the countries are associated to ECMWF
 ** no enough information

There was a progress in local “accessories” implementation in the past 2 years

- > 8/8 countries locally implemented OBSMON but are not using it in-doors yet
- > 7/8 countries locally implemented MANDALAY and are using it regularly
- > 1/8 country is successfully using ODBSQL (ECMWF)
- > 3/8 countries have locally installed HARP
- > 1/8 country is successfully using MONITOR



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DA starters KIT (DAsKIT)

Present **DA starters KIT = Surface DA**: Giard & Bazile, 2000



AROME CY40T1_bf07 (AROME CY43T2_bf10)
Ksh scripts

Planned: to combine it with 3D-VAR (CY43T2_bf10)



DA starters KIT (DAsKIT): surface component (LOCAL)

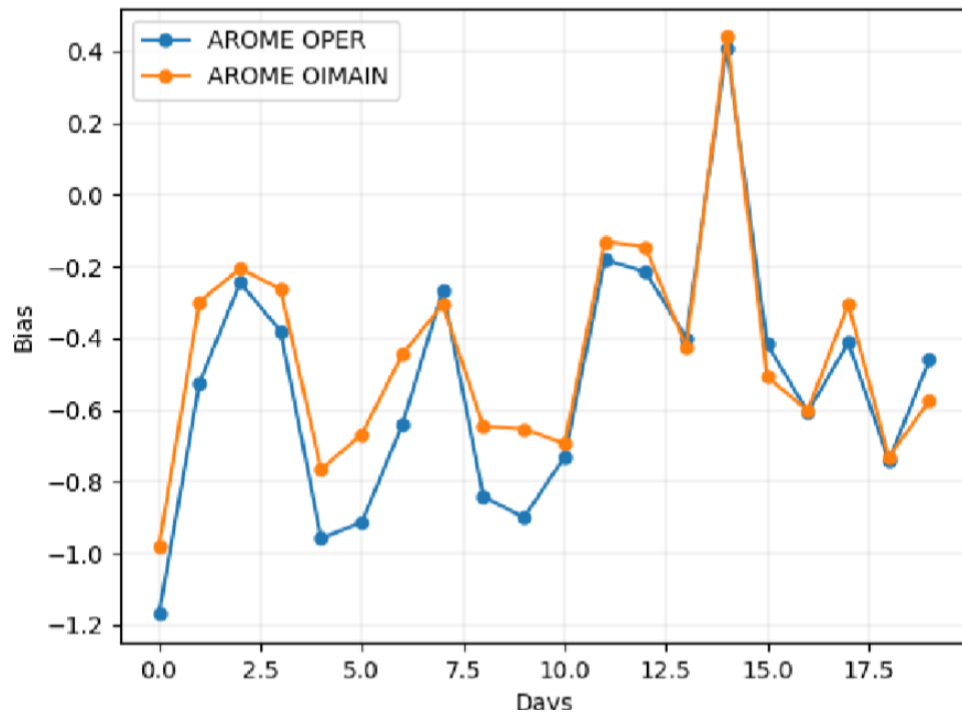
Algeria

2.5 km, 3h-cycling, GTS BUFR

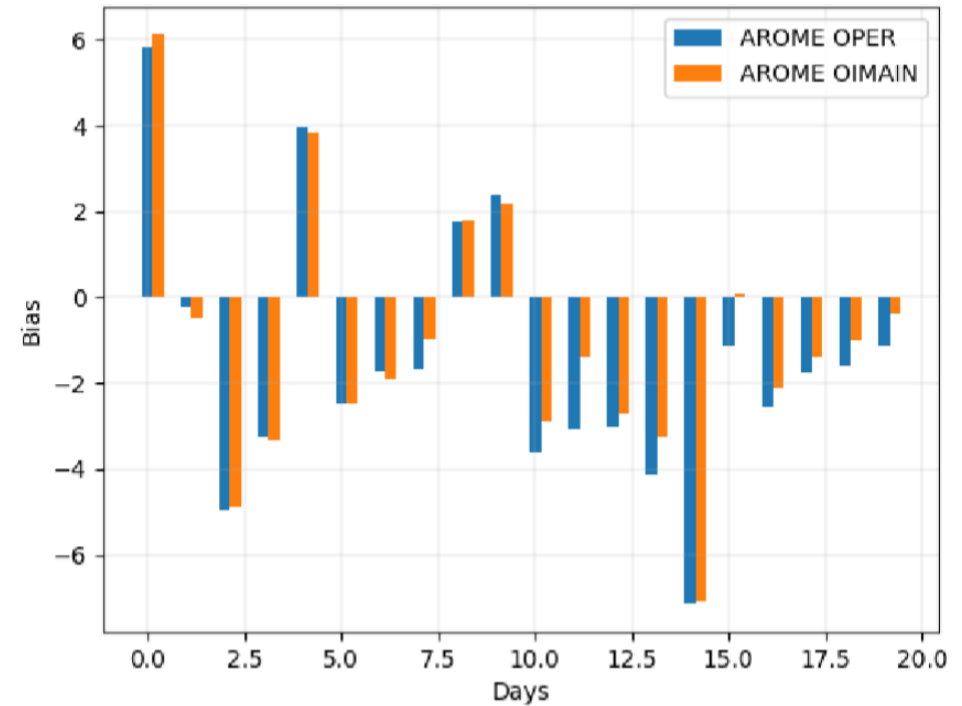
SYNOP

20-day period time series

Bias of parameter t2m
Forecast Network : 00 hour



Bias of parameter clsh
Forecast Network : 00 hour



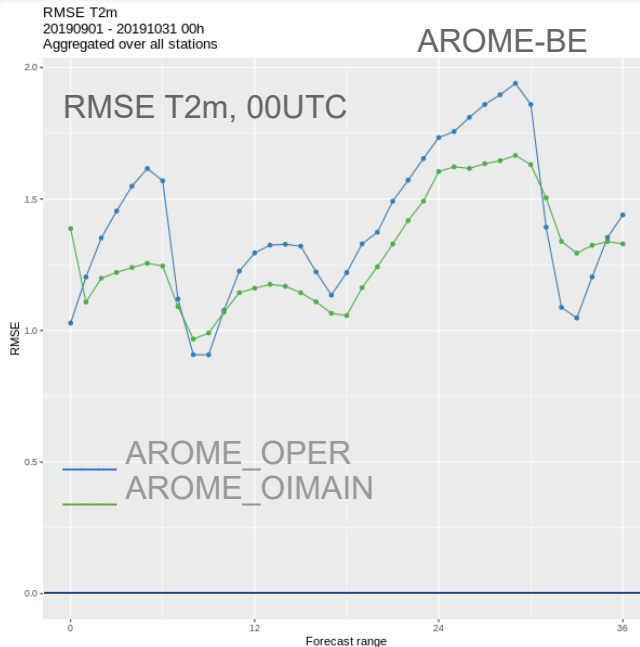


DA starters KIT (DAsKIT): surface component (LOCAL)

Belgium

1.3km, no-CANOPY,
3-h cycling,
GTS BUFR SYNOP
observations
(~260/network)

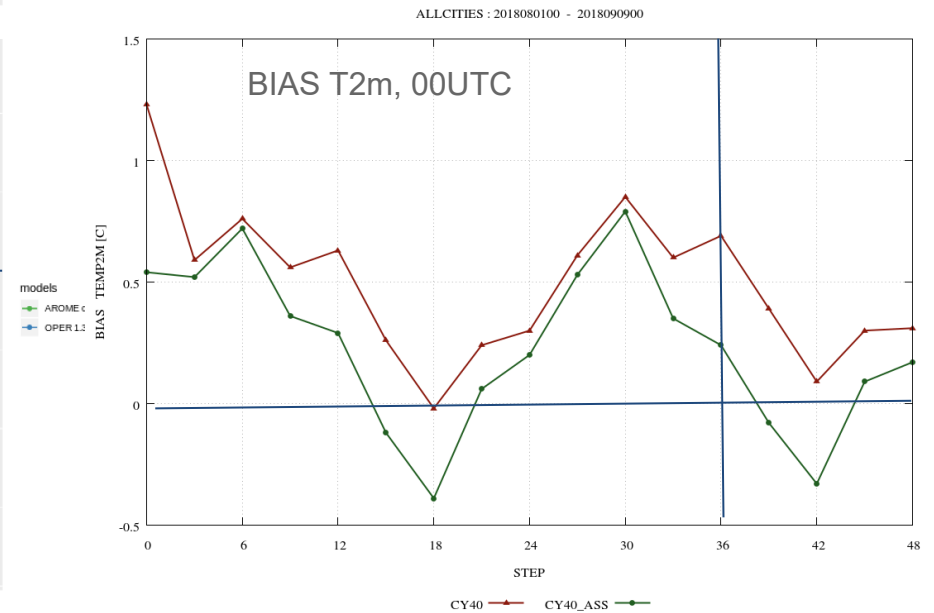
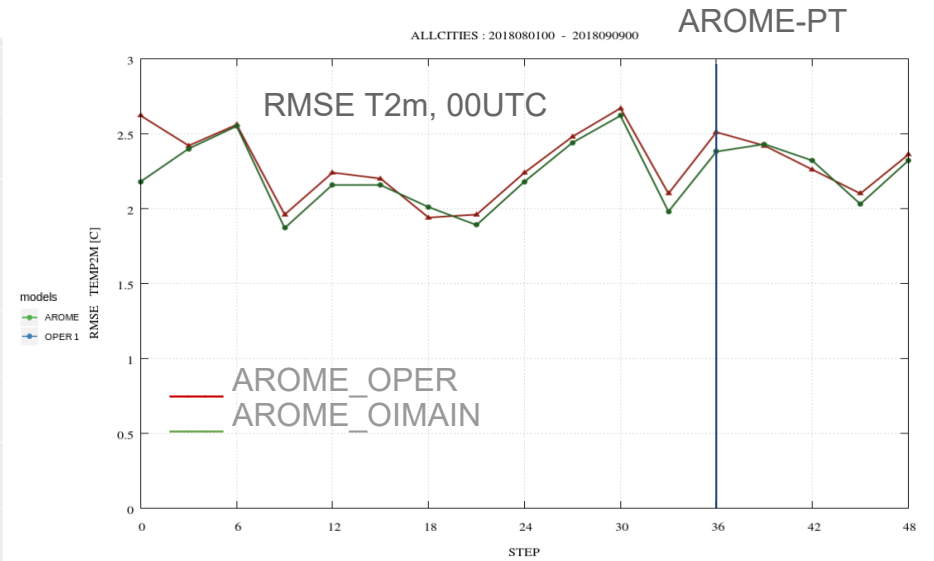
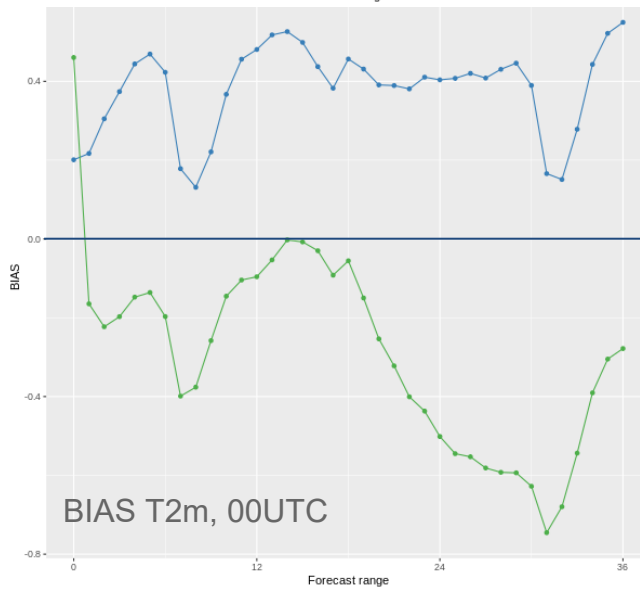
2- month FALL period of
validation



Portugal

2.5km, no-CANOPY,
3-h cycling,
GTS BUFR SYNOP
(~350/network)

~1- month SUMMER
period of validation





DA starters KIT (DAsKIT): surface component (LOCAL)

Turkey

~1- month WINTER period of validation

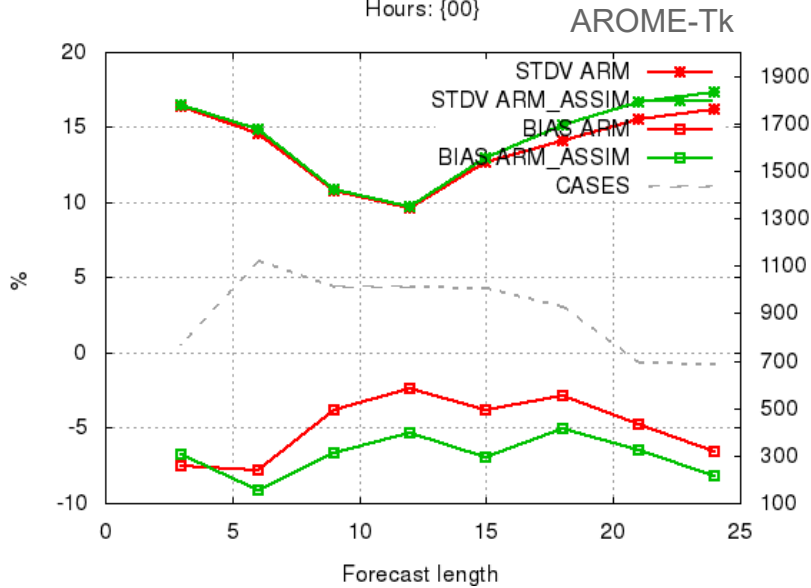
> RMSE (top)
> bias (down)

Portugal

2.5km, no-CANOPY,
3-h cycling,
GTS BUFR SYNOP
(~350/network)

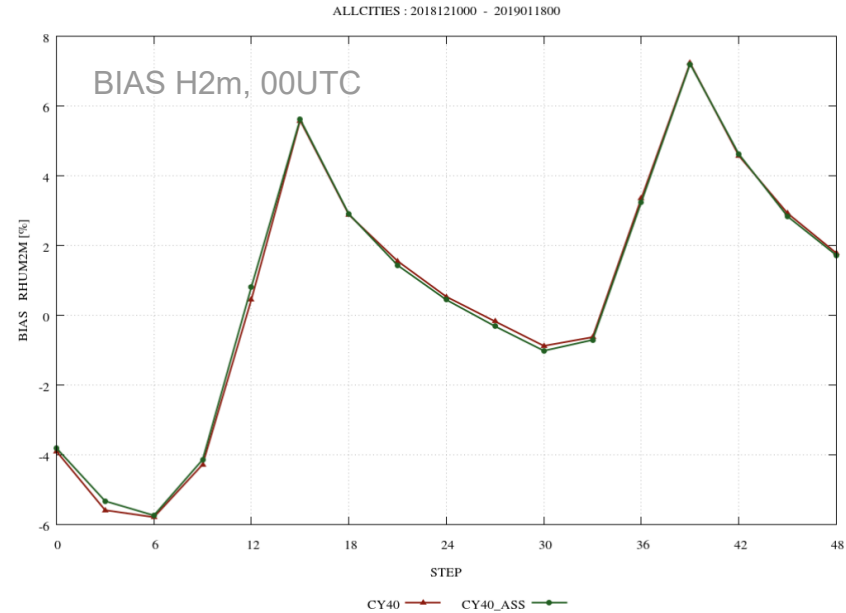
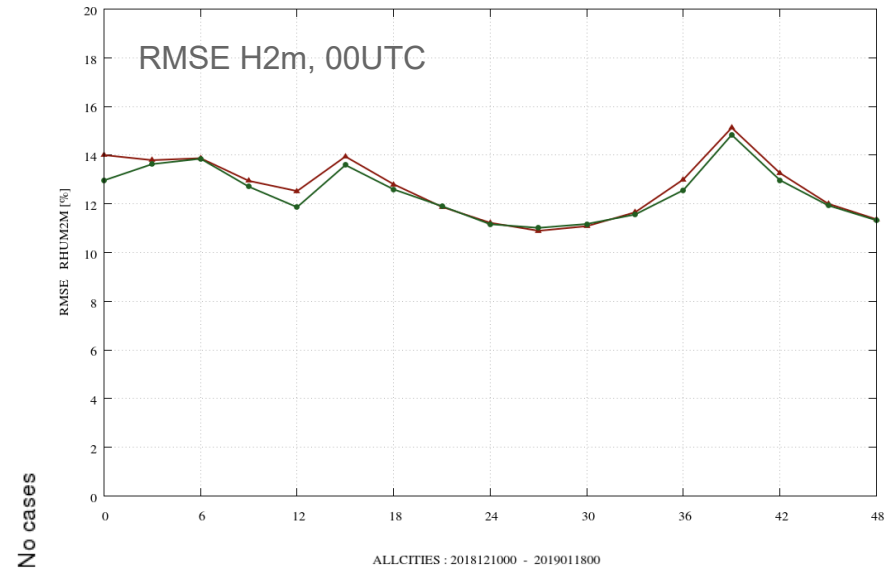
~1- month WINTER period of validation

Selection: ALL using 112 stations
Rh2m Period: 20191103-20191112
Hours: {00}



ALLCITIES : 2018121000 - 2019011800

AROME-PT





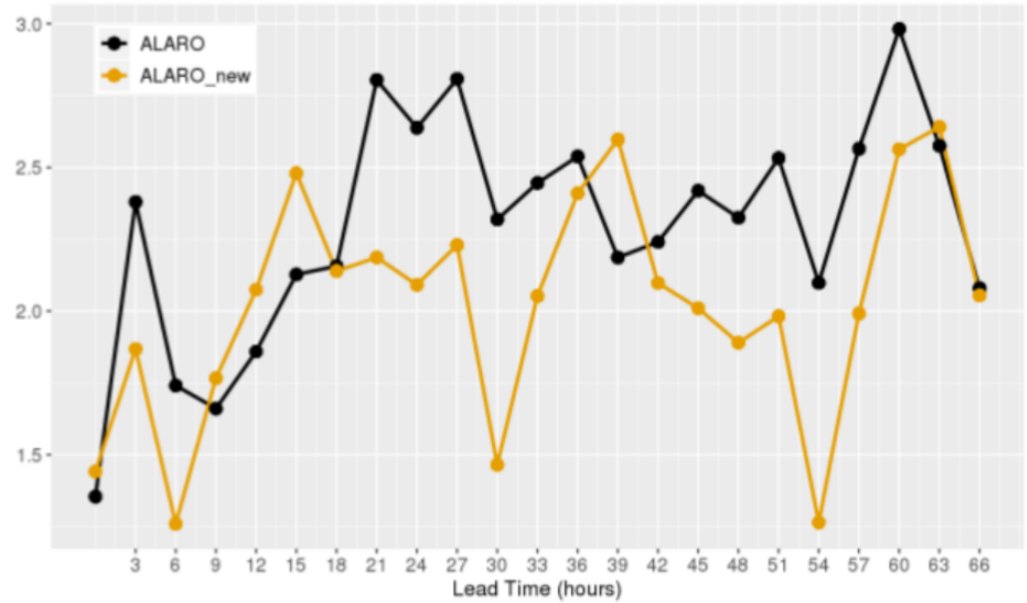
DA starters KIT (DAsKIT): surface component (LOCAL)

Poland

ALARO-CANARI
4.0km, 6h-cycling, OPLACE
ASCII SYNOP, without
SURFEX

~3 weeks cycling

RMSE T2M (degrees)





DA starters KIT (DAsKIT): upper-air component (REF)

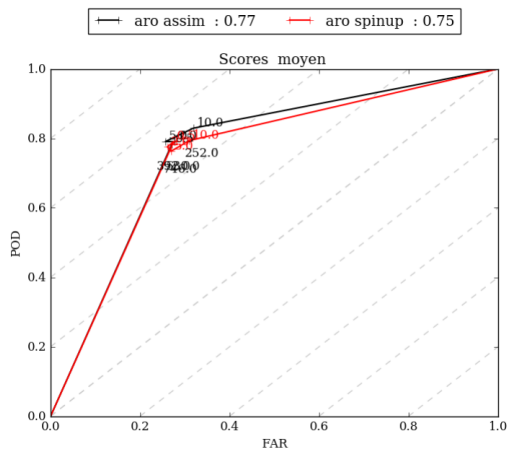
Algeria & Portugal @ Météo_France

B-matrix modeling: flow-dependency aspects of climatological B-matrix using ensemble techniques

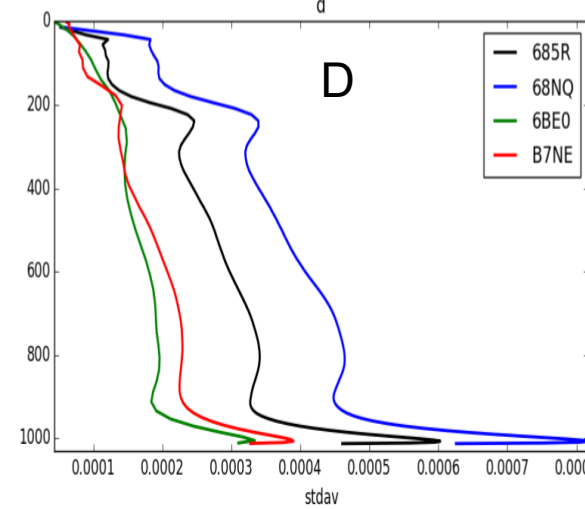
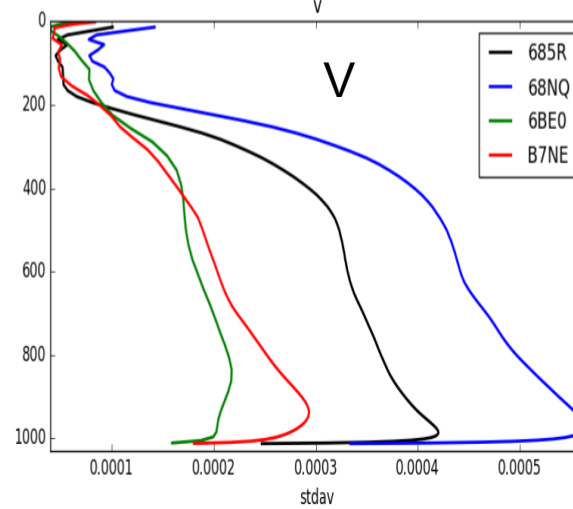
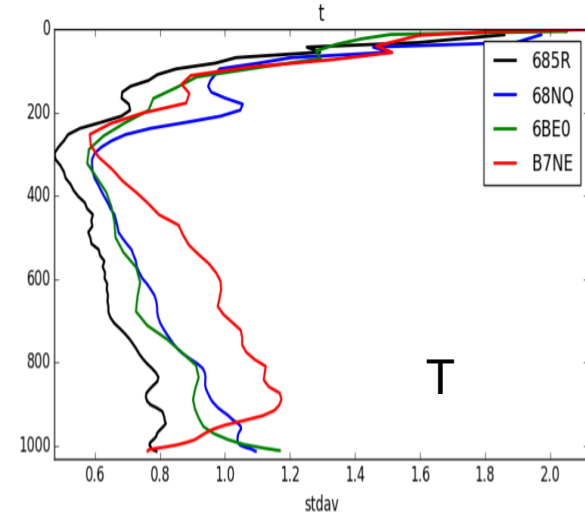
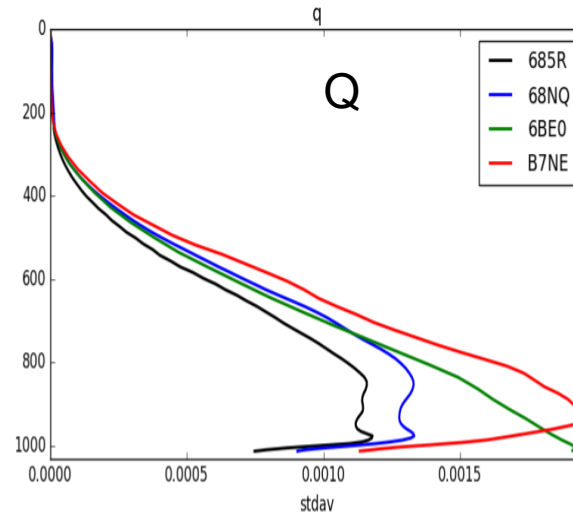
B-Matrix validation of AROME-PT::
2.5km, L60, CY42T2

Validation of combined AROME_PT2
OI_MAIN+3D-Var (CY42T2) has revealed a slight improving using conventional + OIFS
HDF5 volumetric data (Portugal & Spain), in particular for larger amounts of 24-hour accumulated precipitation

(Skill Scores and Probability of Detection), keeping the False Alarm Rates;



Vertical profile of background error standard deviation





DA starters KIT (DAsKIT): upper-air component (REF)

Morocco @ Météo_France

Feasibility/B-matrix validation studies

Case study 19/01/2018: 24h precipitation forecast

http://www.umr-cnrm.fr/aladin/IMG/pdf/assim_morocco_2018.pdf



ALADIN Data Assimilation basic kit Working Days 19-21/09/2018 Bucharest, Romania

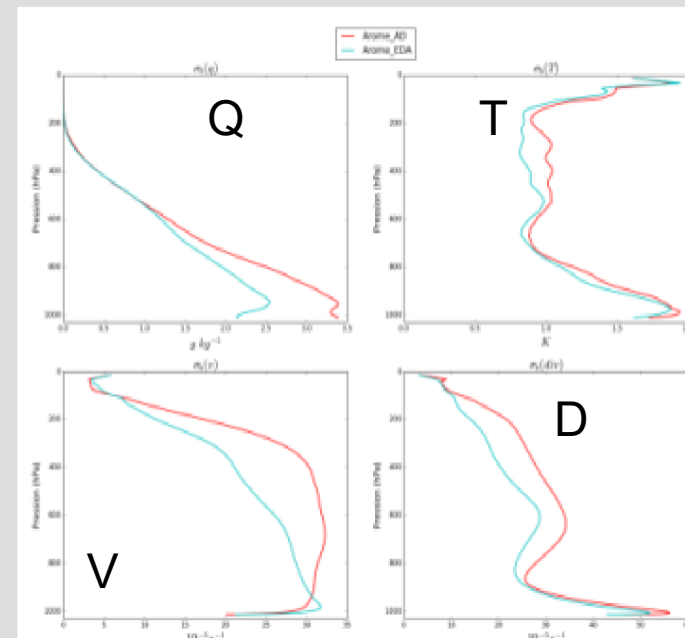
Data assimilation: B matrix

Background-error covariances for AROME:

The first version of the background-error covariances for AROME-Maroc was calculated using AROME forecast ensemble coupled to Arpège in dynamic adaptation mode (Arome_AD).

The operational version is computed using an ensemble assimilation-based method with six independent perturbed assimilation cycles (Arome_EDA).

Vertical profile of background error standard deviation





DA starters KIT (DAsKIT): upper-air component (REF)

Tunisia @ Météo_France

Ensemble B-matrix modeling studies: EDA vs. spin-up

Case study - 23 September 2016
Better Prediction for the cell localization and intensity:

Better Prediction for the cell localization and intensity for Arome 3DVAR compared to Spin up;
Better scores for Arome 3DVAR EDA Bmatrix compared to Bmatrix Spin up

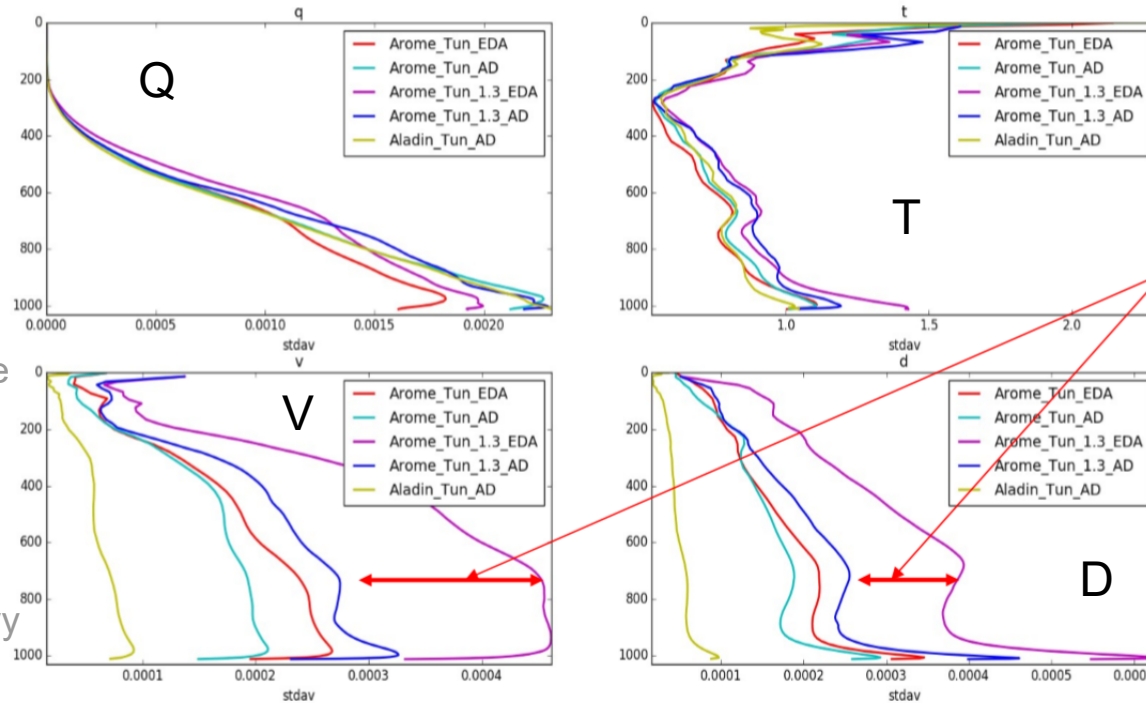
Convective Situation causing heavy rain & flood

http://www.umar-cnrm.fr/aladin/IMG/pdf/wafa_khal-faoui_presentation.pdf



3. AROME-Tunisie 3DVAR Configuration : B matrix diagnostics

Vertical profile of background error standard deviation



Increase in standard deviation of vorticity and divergence of Arome EDA versus Arome Spin up

Vertical profile of the standard deviation of specific humidity (q), temperature (t), vorticity (v) and divergence (d) for AROME-TUNISIE Spinup; AROME-Tunisie EDA and ALADIN-TUNISIE (green dot).

DAsKIT – Prague 19 September 2019



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ARSO METEO Slovenia





Conclusions & outlook

- > All countries have **know-how to set up a DA cycling with conventional data** (GTS BUFR SYNOP, TEMP, E-AMDAR)
- > Efforts are focused on setting a **combined OI_MAIN+3D-VAR DA scheme (CY43)**:
 - . **surface DA KIT** is under validation and results are promising, but tuning efforts are required
 - . **upper-air 3D-VAR** starts to be locally tackled, using as reference recent feasibility studies with appropriate modeling of B-matrix and local high resolution data (for instance, ODIM radar)
- > All countries have **data monitoring tools available locally** (OBSSMON & MANDALAY) but efforts have to be put to its regular usage
- > **Validation tools are still missing** in most of the countries
In particular, there is an opportunity to implement HARP as a common tool, however more investment has to be made in that sense



Conclusions & outlook

- > **Common A-H DA Training Course** (2019) was a great opportunity to learn on actual available DA tools, but not all the DAsKIT countries could be present...
- > There are now **'communication platforms'** between the **DAsKIT partners** (web & forum pages; annual DAsKIT Working Days; regular video-confs)
- > **Foreseen SHORT-TERM ACTIONS**
 - video-conf in June 2020 focus: validation/tuning of surface DA + combined OI_MAIN-3D-Var + issues
 - 2020 Joint LACE DA & DAsKIT WD, Vienna, September 2020

Thank you for your attention !